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INTRODUCTION

This report summarizes major insect and disease activity on forested lands across all ownerships within the State of Idaho for 2003. Much of the information for this report was derived from aerial and ground surveys and associated detection and evaluation activities by insect and disease specialists within the USDA Forest Service and the Idaho Department of Lands. Acres affected and numbers of trees killed reported in text, graphs, and tables are only estimates. Likewise, maps outlining areas of major insect infestations only provide general locations of defoliation and host tree mortality.

Bark beetle and defoliating insect activity is featured in this report because it commonly affects a number of trees in a discrete area and is readily captured in aerial detection surveys (ADS). Trees killed by bark beetles were attacked the year before they were mapped in an aerial detection survey. All described locations, insect-caused mortality, and acres affected are derived from ADS observations, which occur in flight planning "reporting areas." In this document, reporting areas with the most significant amount of insect-caused mortality will be described. National Forest designations include all adjacent state and private ownerships as well as federal lands. Effects of most significant forest diseases are not readily assessed from the air. Therefore, only general information and observations on diseases are reported.

Insects and diseases affect the health of forests in many ways. A broader, more comprehensive discussion of these effects and their significance is contained in USDA R1 Forest Health Protection Report No 99-4 "Health of Idaho's Forests, A Summary of Conditions, Issues and Implications."

CONDITIONS IN BRIEF

FOREST INSECTS

Pine mortality attributed to **mountain pine beetle** decreased on all ownerships throughout Idaho in 2003, with 1,765,854 dead pines detected in 2003, down from 2,534,856 detected in 2002. The largest outbreaks occurred on the Sawtooth National Recreation Area (SNRA), the Nez Perce National Forest (NF) and Salmon-Challis NF. Tree mortality attributed to **pine engraver beetle** and **western pine beetle** increased throughout Idaho in 2003 with 27,876 killed pine trees mapped, up from 14,124 killed pine trees mapped in 2002. **Spruce beetle**-caused mortality was most notable on the Kaniksu NF in 2003 where 1,380 of the total 1,789 ADS mapped spruce beetle- killed trees occurred. This number was an increase over the statewide total of 833 spruce beetle-killed trees detected in ADS in 2002. Aerial Surveys estimate **Douglas-fir beetle** was responsible for 159,352 red Douglas-fir trees mapped in 2003, a considerable increase from 97,686 red Douglas-fir trees mapped in 2002. The largest Douglas-fir beetle outbreaks mapped in 2003 occurred on the Caribou-Targhee, Salmon-Challis, Payette, and Nez Perce NF's, with 59,300, 40,640, 11,670, and 10,778 dead Douglas-fir trees mapped respectively. **Fir engraver** beetle-caused grand fir mortality decreased to 121,760 dead trees mapped in 2003 throughout the state from 130,400 dead trees mapped in 2002 ADS. The largest fir engraver beetle outbreaks were located on the Kaniksu and Nez Perce NF's, and the Nez Perce Indian Reservation. Subalpine fir mortality attributed to **western balsam bark beetle/subalpine fir complex** more than tripled in numbers from 60,000 dead subalpine fir mapped in 2002 ADS, to 191,253 subalpine fir mapped in 2003 ADS. Nearly three-fifths of the total subalpine fir killed were located on the Kaniksu and Salmon-Challis NF's. Subalpine fir damage due to the **balsam woolly adelgid** was mapped on over 14,000 acres, down from 85,400 acres mapped in 2002. Most damage was mapped on the St. Joe and Kaniksu NF's, and adjacent State, private, and BLM lands. No visible defoliation was recorded for Douglas-fir tussock moth in 2003 indicating the end of an outbreak that peaked in 2001 with nearly 142,000 acres defoliated. Defoliation from **western spruce budworm** increased to 178,675 acres defoliated in 2003 ADS compared to 15,175 acres defoliated in 2002 ADS. Defoliation occurred on the Boise, Caribou-Targhee, Salmon-Challis, and Kaniksu NF's. There was no visible defoliation caused by **larch casebearer** in 2003 ADS.

FOREST DISEASES
Impacts caused by forest pathogens are not accurately captured by aerial survey methods. Other assessment methods primarily utilizing ground survey are most effective at describing the effects of many pathogens.

FOREST INSECTS

BARK BEETLES

Mountain Pine Beetle

Mountain pine beetle (MPB) continues to be the most frequently encountered and damaging bark beetle in the state. This beetle attacks and kills all locally occurring pine species. MPB-caused pine mortality decreased considerably in 2003 compared to the previous nine straight years of continued growth, with an estimated 1,765,854 dead pines mapped over 344,448 acres (Table 1) across all land ownerships in 2003 ADS. In 2002 an estimated 2,534,856 pine trees were killed on nearly 339,322 acres. There is speculation that the beetles are depleting suitable hosts in some of these areas, which may explain the decrease in mapped dead pines. Just less than two-thirds of this mortality occurred in southern Idaho on the **Salmon-Challis and Sawtooth NF's** and the **SNRA**, and largely consists of lodgepole pine (Table 2). On the **Nez Perce NF** in northern Idaho, the MPB infestation persists in lodgepole pine, impacting landscapes throughout the reporting area. Continued warmer and drier weather conditions have favored beetle survival enabling beetle populations to increase significantly during the last decade. Impacts from these infestations include the loss of scenic visual corridors, cover and screening for wildlife, and increases in stream temperatures that may affect the spawning of endangered salmon species.

Year	MPB Killed Trees	Acres Infested	Year	MPB Killed Trees	Acres Infested
2003	1,765,854	344,448	1997	62,914	54,667
2002	2,534,856	339,322	1996	41,073	33,098
2001	1,270,402	165,858	1995	16,862	17,850
2000	485,957	123,225	1994	8,464	7,045
1999	127,605	83,818	**Total**	**6,398,929**	**1,250,980**
1998	84,942	81,649			

Table 1. Aerial detection survey (ADS) results for Mountain Pine Beetle in the State of Idaho from 1994-2003. Results reported include estimated number of dead pine trees (all species) and acres infested mapped by ADS year.

Mountain pine beetle-caused whitebark pine mortality continued to increase in 2003, to just over 102,260 trees killed on 30,153 acres. The largest outbreak was located on the **Kaniksu NF** with nearly 39,000 dead white bark pine mapped over 12,712 acres south of the US/Canada border. In southern Idaho, over 30,000 dead whitebark pine were mapped on the **Caribou-Targhee NF** on 4,960 acres. Mortality caused by MPB in western white pine decreased sharply from nearly 39,000 dead trees mapped over 17,579 acres in 2002, to 6,301 dead trees mapped over 7,856 acres in 2003. Most MPB-killed white pine was mapped on the **Coeur d'Alene** and **Kaniksu NF's**. Mountain pine beetle-caused mortality in ponderosa pine stands is of concern in some areas. Ponderosa pine tree mortality attributed to the mountain pine beetle nearly tripled this year for a total of 15,096 dead trees on 12,679 acres, up from 5,559 dead ponderosa pine trees mapped on just over 4,700 acres in 2002. Over 8,000 of these killed ponderosa pine trees were located on the **Nez Perce NF**.

Northern Idaho: The MPB infestation on the **Nez Perce NF** continues to affect lodgepole pine across landscapes administered by the Forest Service's Elk City Ranger District. This outbreak is likely to

continue as long as warm and dry conditions persist along with susceptible host availability. Rapidly building populations of beetles in lodgepole on the **Coeur d'Alene** and **St. Joe NF's** are producing high levels of mortality across landscapes of the Bitterroot Mountains, affecting areas of the old Wallace and Red Ives Ranger Districts. Beetle-killed lodgepole on the **Kaniksu NF** is found predominantly in areas of the upper Selkirk Mountain Range. Whitebark pine on the **Kaniksu NF** continues to sustain heavy losses in high elevations also found within the upper Selkirks and north of Katka Peak. These rare pine stands are declining primarily from aggressive MPB attacks, combined with white pine blister rust infections, fire suppression, shade tolerant species invasion and consequent overstocking, and over-maturation of whitebark stands. Whitebark pine ecosystems are highly valued for watershed stability, recreation, and wildlife purposes. The heavy whitebark pine seeds are also an important food source for numerous birds and small mammals, as well as food for the threatened and endangered grizzly bear.

Southern Idaho: High populations of MPB continue to infest lodgepole pine, causing mortality at landscape levels throughout the **Sawtooth NF** and the **SNRA**. On the southern portion of the **Sawtooth NF**, heavy MPB-caused mortality was detected on federal and state lands located along the Albion Mountain Range, starting around Stines pass and continuing northeast up to Connor Ridge. Numerous drainages throughout the **SNRA** exhibited high lodgepole pine losses. On the **Salmon-Challis NF**, Morgan Creek and Challis Creek watersheds west of Challis contained high lodgepole mortality. Whitebark pine mortality in reporting areas of southern Idaho showed higher incidences on the **Caribou-Targhee, Sawtooth,** and **Salmon-Challis NF's**. On the **Caribou-Targhee NF**, dying whitebark pine were detected in the vicinity of Sawtell Peak southwest of Henry's Lake, within the Centennial Mountain Range (particularly in areas around Hancock and Aldous Lakes), and on ridges of the southern end of the Beaverhead Mountain Range. On the **Sawtooth NF**, scattered groups of infested trees were observed, with concentrations found mostly on the Smokey Mountain Range east of Ketcham, portions of the Boulder Mountain Range, and the southern end of the Sawtooth Range. Scattered mortality was also found on the **Salmon-Challis NF**, with more detections occurring on the Lemhi Range and the southern portion of the Pioneer Mountains.

Table 2. Mountain Pine Beetle Aerial Detection Survey (ADS) results for the state of Idaho 2002-2003. Acres infested, Dead Trees, and MBF Volume for white pine, ponderosa pine, lodgepole pine, and whitebark pine.

		MPB (white pine) Estimated Mortality			**MPB** (ponderosa pine) Estimated Mortality			**MPB** (lodgepole pine) Estimated Mortality			**MPB** (whitebark pine) Estimated Mortality		
AREA	Year	Acres Infested	Red Trees	MBF Volume	Acres Infested	Red Trees	MBF Volume	Acres Infested	Red Trees	MBF Volume	Acres Infested	Red Trees	MBF Volume
Bitterroot	2002 2003	0 0	0 0	0.0 0.0	0 524	0 321	0.0 25.7	6 0	20 0	1.8 0.0	0 78	0 54	0.0 0.0
Boise	2002 2003	0 0	0 0	0.0 0.0	0 0	0 0	0.0 0.0	3,389 2,032	11,244 4,257	719.6 68.1	1,898 835	10,217 956	1,123.9 19.2
Clearwater	2002 2003	212 720	95 571	38.0 228.4	41 10	5 12	0.4 1.0	2,111 3,236	1,914 4,765	172.3 428.9	0 2	0 11	0.0 1.2
Coeur d'Alene	2002 2003	10,242 1,583	33,798 2,305	7.2 922.0	2 0	1 0	0.1 0.0	2,035 1,453	16,221 6,960	1,459.9 626.4	0 0	0 0	0.0 0.0
Kaniksu	2002 2003	4,744 5,149	2,817 2,876	1,126.8 1,150.4	2,013 3,121	2,320 2,229	185.6 178.3	14,246 19,007	16,455 29,875	1,481.0 2,688.8	12,678 12,712	40,692 38,672	4,476.1 4,253.9
Kootenai	2002 2003	50 4	1107 6	442.8 2.4	0 6	0 12	0.0 1.0	2 76	11 61	1.0 5.5	0 0	0 0	0.0 0.0
Nez Perce	2002 2003	187 0	186 0	74.4 0.0	1,079 4,204	1,198 8,080	95.8 646.4	160,640 104,771	1,225,254 440,139	110,272.9 39,612.5	273 437	223 448	24.5 49.3
Payette	2002 2003	0 0	0 0	0.0 0.0	0 0	0 0	0.0 0.0	858 1,492	3,890 7,487	249.0 119.8	391 1,519	2,772 2,368	304.9 47.4
Salmon-Challis	2002 2003	0 0	0 0	0.0 0.0	325 0	636 0	25.4 0.0	17,559 50,997	193,435 226,448	314,943.1 3,623.2	537 3,592	1,787 10,441	196.6 208.8
Sawtooth	2002 2003	0 0	0 0	0.0 0.0	0 0	0 0	0.0 0.0	52,072 77,302	844,172 843,479	24,027.0 13,495.7	1,755 5,613	4,922 18,162	541.4 363.2
St. Joe	2002 2003	465 52	75 75	30.0 30.0	441 1,658	284 670	22.7 53.6	16,473 18,849	20,761 25,662	1,868.5 2,309.6	0 0	0 0	0.0 0.0
Targhee-Caribou	2002 2003	0 0	0 0	0.0 0.0	0 36	0 55	0.0 1.1	1,897 521	6,385 568	408.6 11.4	884 4,960	3,366 29,805	370.3 596.1
Indian Res.	2002 2003	0 0	0 0	0.0 0.0	0 0	0 0	0.0 0.0	68 10	149 40	9.5 1.0	0 0	0 0	0.0 0.0
BLM	2002 2003	112 57	86 68	1.7 1.1	2 475	1 639	.02 12.8	12,317 4,756	6,534 11,464	130.7 229.3	10 324	10 1,167	0.2 23.3
Other Lands	2002 2003	1,567 291	768 400	307.2 84.0	809 2,651	1,114 3,078	83.7 147.7	14,808 9,298	80,666 40,990	6,775.0 2,172.5	124 81	132 178	14.6 11.2
Idaho Totals	2002 2003	17,579 7,856	38,932 6,301	2028.1 2,418.3	4,712 12,679	5,559 15,096	413.8 1,067.6	298,481 293,800	2,427,111 1,642,195	462,519.9 65,372.7	18,550 30,153	64,121 102,262	7,052.5 5,573.6

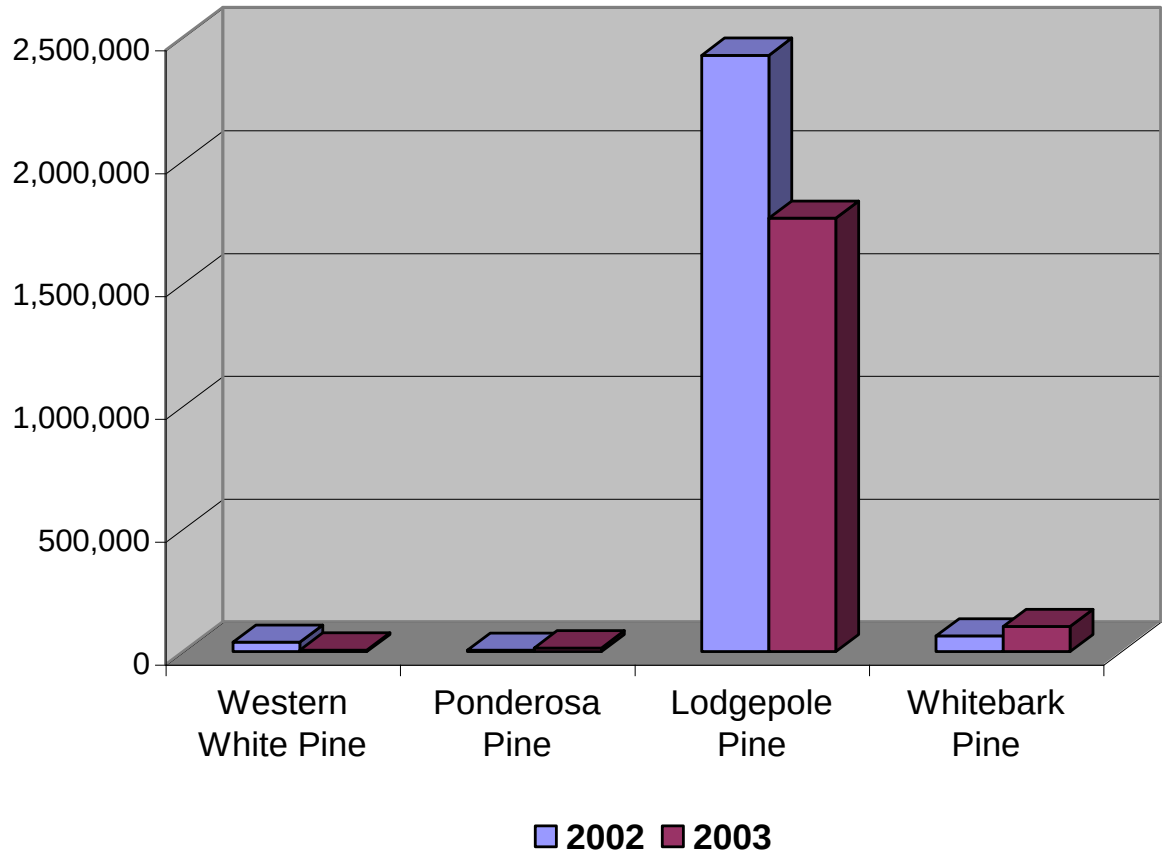

Figure 1. Numbers of Mountain Pine Beetle Killed Trees by Host Species as Determined by Aerial Surveys in Idaho 2003.

Pine Engraver

Pine engraver beetle mortality increased significantly in 2003 likely a result of continued drought and warm temperatures across the state. Ponderosa pine was most frequently killed. Numbers of dead pine increased from 2,465 killed trees on 1,223 acres in 2002 ADS, to 8,973 killed trees on 3,839 acres in 2003 ADS (Table 3, Fig. 2). Some of this mortality was dispersed across private and Tribal lands within the **Nez Perce NF** and the **Nez Perce Indian Reservation (NPIR),** while most occurred on the **Salmon-Challis NF** (concentrations found along drainages west of the West Mountain Range, and drainages into the Little Salmon River from Pollock to Round Valley), State, and private lands.

Western Pine Beetle

Ponderosa pine mortality attributed to western pine beetle (WPB) increased from 2002 ADS recorded levels. In 2003, ADS estimated western pine beetle at 18,903 dead trees (Table 3, Fig.2) across 16,682 acres. There still remains the potential for WPB populations to increase due to continued warm and dry conditions and residual susceptible host trees remaining from the 2000 fires.

Northern Idaho: Private lands within the reporting areas sustained a majority of the WPB infestations. On the **Clearwater NF**, many areas of scattered WPB mortality were observed, with higher beetle populations occurring in areas located in drainages of the Palouse River east of Potlatch to Harvard, south to Begs Creek, and west to Rocky Point, and in the vicinity of Little Boulder Campground southeast of

Deary. The **NPIR** showed areas of dispersed WPB mortality, with the highest incidence of beetle-killed trees occurring between the Eagle and Deer Creek drainages just south of Larabee Meadows.

Southern Idaho: On the **Payette NF**, pockets of WPB mortality were found throughout drainages west of the West Mountain Range, and between Warren and French Creeks. Western Pine Beetle-killed trees were found scattered across watersheds of the North Fork Range and the Salmon River Mountains on the **Boise NF.**

Spruce Beetle

Spruce beetle populations remained low statewide in 2003. Infested acres and mortality increased in the north and decreased in the south. 2003 ADS estimates 1,800 red trees on 778 acres compared to only 205 red trees on just over 140 acres in 2002 ADS (Table 3, Fig. 2).

Northern Idaho: ADS mapped mortality occurred mostly as small, scattered groups across the **Kaniksu NF**, with several larger groups of beetle-attacked trees recorded in the vicinity of Joe Peak on the north end of Bugle Ridge, lands south of Marsh Lake, and portions of the upper Cow Creek drainage.

Southern Idaho: Minor outbreaks occurred on the **Salmon-Challis NF** in the vicinity of Iron Bog trailhead just east of Iron Bog Lake, and on the southern end of the Chamberlain Basin within the **SNRA**.

Table 3. 2003 Idaho Statewide Aerial Detection Survey (ADS) Summary for Fir Engraver Beetle, Western Pine Beetle, and Spruce Beetle (Acres Infested, Red Trees and MBF Volume Lost) by ADS reporting area.

		Pine Engraver Beetle Estimated Mortality (PP&LPP)			**Western Pine Beetle** Estimated Mortality			**Spruce Beetle** Estimated Mortality		
AREA	Year	Acres Infested	Red Trees	MBF Volume	Acres Infested	Red Trees	MBF Volume	Acres Infested	Red Trees	MBF Volume
Bitterroot	2002	0	0	0.0	0	0	0.0	0	0	0.0
	2003	0	0	0.0	0	0	0.0	0	0	0.0
Boise	2002	0	0	0.0	555	1,026	564.3	105	345	164.9
	2003	20	60	1.0	1,570	1,572	31.4	25	30	2.7
Clearwater	2002	343	186	3.7	320	298	119.2	65	88	35.2
	2003	15	20	0.4	907	957	382.8	18	12	6.0
Coeur d'Alene	2002	47	62	1.6	57	47	18.8	6	3	1.2
	2003	29	173	4.3	211	222	88.8	4	12	4.8
Kaniksu	2002	0	0	0.0	13	20	8.0	33	91	36.4
	2003	28	71	1.6	70	94	37.6	544	1379	551.6
Kootenai	2002	0	0	0.0	0	0	0.0	0	0	0.0
	2003	0	0	0.0	0	0	0.0	0	0	0.0
Nez Perce	2002	0	0	0.0	157	155	62.0	4	2	0.8
	2003	468	1158	26.6	230	345	138.0	42	70	28.0
Payette	2002	0	0	0.0	595	1,144	629.2	5	10	4.8
	2003	0	0	0.0	1,295	1,884	37.7	10	15	1.4
Salmon- Challis	2002	0	0	0.0	180	43	23.7	10	15	1.4
	2003	2,064	5,094	81.5	0	0	0.0	43	100	9.0
Sawtooth	2002	0	0	0.0	239	180	99.0	147	205	98.0
	2003	0	0	0.0	70	141	2.8	80	160	14.4
St. Joe	2002	0	0	0.0	4	7	2.8	33	21	8.4
	2003	0	0	0.0	10	12	4.8	0	0	0.0
Targhee-Caribou	2002	0	0	0.0	0	0	0.0	0	0	0.0
	2003	0	0	0.0	0	0	0.0	0	0	0.0
Indian Res.	2002	0	0	0.0	328	613	245.2	0	0	0.0
	2003	470	1,162	26.7	423	534	213.6	0	0	0.0
BLM	2002	0	0	0.0	173	347	163.3	0	0	0.0
	2003	0	0	0.0	548	788	15.8	0	0	0.0
Other Lands	2002	833	2,217	55.2	5,983	7,779	3,371.4	37	53	23.2
	2003	745	1,235	28.4	11,348	12,354	2,594.3	12	11	.2
Idaho Totals	2002	1,223	2,465	60.5	8,604	11,659	5,306.9	445	833	30.1
	2003	3,839	8,973	170.5	16,682	18,903	3,547.6	778	1789	618.1

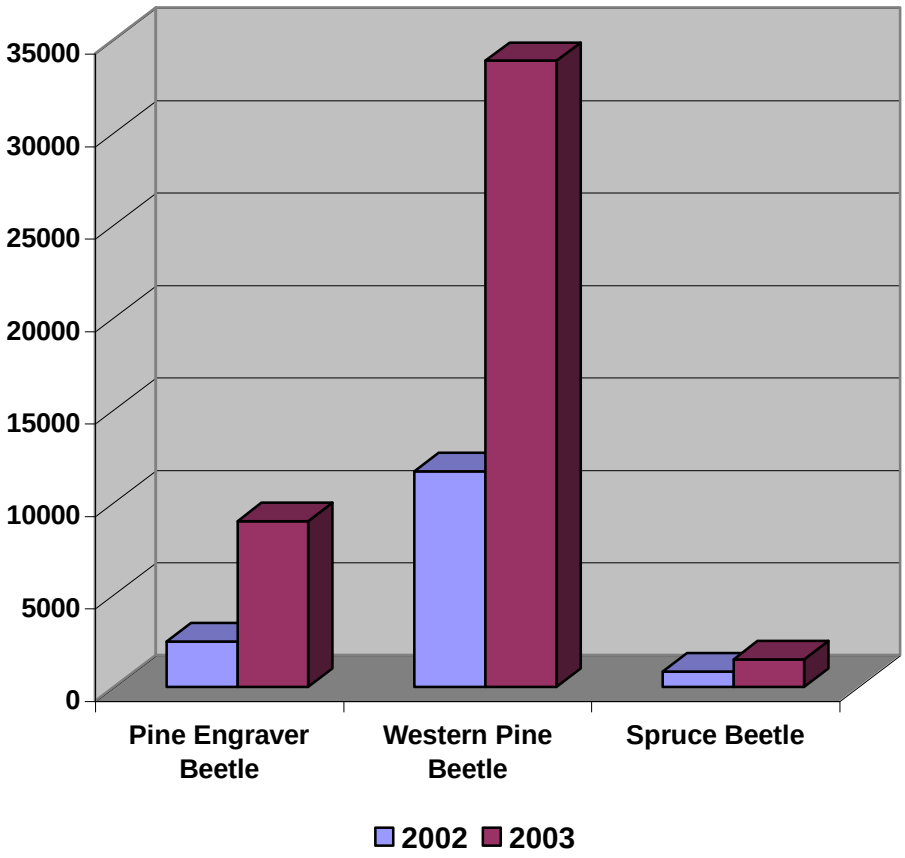

Figure 2. Aerial Detection Survey (ADS) 2002 and 2003 estimated
Pine and Spruce Mortality (number of red trees) by Bark Beetle Species

Douglas-fir Beetle

Douglas-fir Beetle (DFB) mapped red Douglas- fir (DF) trees increased substantially in 2003, with 159,352 red DF trees on 49,157 acres compared to 97,686 red DF trees on 52,768 acres in mapped in 2002 (Table 4, Figure 3). Douglas-fir beetle populations are still considerably high on Forests that had significant acreage affected by fire in 2000.

Northern Idaho: Dispersed pockets of DFB-caused mortality were found on the **Kaniksu NF** starting in the vicinity of Troy and across landscapes south to the Clark Fork River. Large groups of beetle-killed trees were mapped in drainages on the east side of Priest and Upper Priest Lakes, starting at the southern base of Hughes Ridge and continuing south to Goose Creek. On the **Nez Perce NF**, groups of beetle-caused mortality were found along the Meadow Creek and Johns Creek drainages, and between the West Fork of the Rapid River and Papoose Creeks, west of Riggins.

Southern Idaho: On the **Caribou-Targhee NF**, high DFB activity was found in drainages on the north half of the Caribou and Snake River Ranges, which flow into the Snake River and the Palisades Reservoir, and along areas of the Portneuf Range east of Pocatello. **Salmon-Challis NF,** DFB activity was more pronounced in areas between Taylor Peak and Williams Lake, southwest of Salmon. The **Payette** had heavy DFB-caused mortality along drainages of the Middle Fork of Smith Creek, areas surrounding and radiating east of Johnson Creek Guard Station, and in areas north of the Brownlee Guard Station. On the **Sawtooth**, DFB mortality centers were found throughout drainages west of Ketchum to the Smokey Mountains.

Fir Engraver

Fir engraver beetle (FEB)-caused grand fir mortality decreased in 2003 after several years of significant increases. An estimated 121,760 red grand fir trees were mapped statewide over 152,058 acres. In 2002, 130,400 red grand fir trees were mapped over 111,939 acres (Table 4, Figure 3). Fir engraver beetle populations and damage to trees will likely remain high until typical moisture patterns return to the state. Northern Idaho also has a high amount of root disease in many grand fir stands that increases grand fir's susceptibility to FEB attack. Outbreaks of FEB are usually associated with drought.

Northern Idaho: On the **Nez Perce NF**, other Federal, State, and private lands exhibited high beetle-caused mortality in many drainages leading into the Salmon and South Fork of the Clearwater Rivers. Beetle-killed trees on the **NPIR** were found in drainages flowing east off the Craig Mountain range, in the vicinity of Lapwa Lake, and in drainages east of Cottonwood. Tree mortality on the **St. Joe NF** was scattered, but with concentrations found in areas of Little Sand Mountain east of Harvard, and along the Santa and St. Maries Creeks north and west of Santa. Dispersed pockets of mortality were mapped across the **Kaniksu NF**, with higher concentrations found throughout drainages located on the south end of Lake Pend Orielle, across landscapes north and west of Farragut State Park, and locations northwest of the town of Priest River to the Pelke Divide. The **Clearwater NF** sustained heavy mortality in the vicinity south and east of Weippe, with many more mortality pockets dispersed across landscapes.

Southern Idaho: Beetle-caused mortality on the **Payette NF** was found predominantly in drainages along the West Mountain Range (west of the Cascade Reservoir), and areas along the Hornet Creek drainage, southwest of the Hornet Guard Station.

Western Balsam Bark Beetle/Subalpine Fir Complex

Western balsam bark beetle/sub-alpine fir complex (WBBB/SAF) was the identified cause for 191,253 red subalpine fir mapped across 99,434 acres in 2003 ADS, a considerable increase from 115,036 red subalpine fir mapped over 74,776 statewide in 2002 ADS (Table 4, Figure 3). Much of the subalpine fir mortality occurring in these environments results from varying combinations of root diseases, bark beetles, and possibly other factors such as climatic change. Western balsam bark beetle (WBBB) is thought to be the most significant mortality factor. A woodstaining, pathogenic fungus carried by WBBB appears to cause mortality even when the beetles only lightly attack trees. Decline and die-off of subalpine fir started in the late 1980's. Peak mortality periods occurred during the mid-1990's when over a million trees were affected. Although there are a number of pathogens affecting subalpine fir mortality, the primary insect involved is the WBBB, although the exotic Balsam Woolly Adelgid may also play a role in some areas. Ground examinations suggest a number of factors that contribute to the complex, including: twig beetles, secondary bark beetles, wood borers, fir engraver beetles, root diseases, cankers, and rusts. Drought, heat stress, and winter drying, compounded by overstocked and overmature stand conditions also contribute to subalpine fir mortality.

Northern Idaho: Dispersed mortality pockets were mapped across the **Kaniksu NF,** with larger tracts observed in areas of Upper Priest Lake River and in drainages across the upper Selkirk Mountain Range. On the **Clearwater NF,** scattered groups of mortality were recorded across landscapes, with higher incidences in the vicinity of Fish Lake (northwest of the old Kelley Creek Workcenter), and areas of Monroe Butte and Monroe Lake. The **Nez Perce NF** displayed areas of beetle damage around Lost Lake and north of the Gospel Hump Wilderness, while observations on the **St. Joe NF** showed drainages between Cascade and Wisdom Peaks to have high tree mortality.

Southern Idaho: The **Salmon-Challis NF** showed the highest incidence of WBBB damage across areas of the Lemhi Range south of Salmon. Within the **SNRA**, beetle-killed trees were recorded across landscapes of the Boulder and Smokey Mountain Ranges. On the **Caribou-Targhee NF**, more prominent beetle activity was recorded on the Elkhorn Mountains west of Downey, and areas north of Toponce Guard Station on the Fort Hall Indian Reservation.

Table 4. Aerial Detection Survey (ADS) results by reporting area for the Douglas-fir beetle, Fir Engraver, Western Balsam Bark Beetle, and Subalpine fir complex for the state of Idaho, ADS years 2002 and 2003.

		Douglas-fir Beetle Estimated Mortality			**Fir Engraver** Estimated Mortality			**Western Balsam Bark Beetle** Estimated Mortality			**Subalpine fir Complex** Estimated Mortality		
AREA	Year	Acres Infested	Red Trees	MBF Volume	Acres Infested	Red Trees	MBF Volume	Acres Infested	Red Trees	MBF Volume	Acres Infested	Red Trees	MBF Volume
Bitterroot	2002	3,546	8,444	2,955.4	0	0	0.0	0	0	0.0			
	2003	66	35	12.3	0	0	0.0	0	0	0.0			
Boise	2002	1,883	6,204	2,171.4	265	991	188.3				263	970	106.7
	2003	2,027	4,497	134.9	776	1,325	39.8				741	1,563	31.3
Clearwater	2002	7,320	13,301	4,655.4	1,449	2,056	411.2	2,246	3,616	397.8			
	2003	1,170	2,578	902.3	417	843	168.6	2,970	4,518	497.0			
Coeur d'Alene	2002	9,274	8,862	3,101.7	2,058	2,457	491.4	2,302	7,702	847.2			
	2003	615	1,356	474.6	547	1,513	302.6	854	2,542	279.6			
Kaniksu	2002	5,882	9,125	3,193.8	10,297	13,963	2,792.6	18,547	19,786	2,176.5			
	2003	5,415	7,742	2,709.7	27,232	26,694	5,338.8	49,788	87,728	9,650.0			
Kootenai	2002	193	292	102.2	0	0	0.0	0	0				
	2003	100	88	30.8	0	0	0.0	4	12	0.0			
Nez Perce	2002	3,544	7,933	2,776.6	15,676	38,397	7,679.4	27,746	26,966	2,966.3			
	2003	3,544	10,608	3,712.8	6,925	14,462	2,892.4	5,406	8,037	844.1			
Payette	2002	290	965	137.0	1,237	2,323	441.4				812	1,498	164.8
	2003	5,926	11,670	350.1	3,188	4,949	148.5				2,109	3,507	70.1
Salmon-Challis	2002	2,259	3,983	565.6	0	0	0.0				5,646	16,285	1,791.4
	2003	1,600	40,640	1219.2	0	0	0.0				12,314	30,022	600.4
Sawtooth	2002	1,664	4,390	623.4	15	22	4.2				11,353	28,129	3,094.2
	2003	3,191	10,778	323.3	0	0	0.0				6,536	26,800	536.0
St. Joe	2002	2,427	4,387	1,570.5	2,044	2,230	446.0	974	641	70.5			
	2003	787	3,004	1,051.4	3,233	2,177	762.0	5,925	5,159	567.5			
Targhee-Caribou	2002	10,402	23,242	3,300.4	0	0	0.0				3,330	7,056	776.2
	2003	21,247	59,299	1,779.0	1,055	2,717	81.5				7,792	14,304	222.6
Indian Res.	2002	116	183	37.1	300	548	109.6	0	0	0.0	380	740	81.4
	2003	59	127	44.5	589	535	107.0	0	0	0.0	463	777	85.5
BLM	2002	474	963	291.5	1,668	1,658	331.6	12	18	2.0	30	40	4.4
	2003	654	1,276	38.3	2385	2,419	72.6	80	110	2.2	456	774	15.5
Other Lands	2002	3,494	5,412	1,740.1	76,930	65,755	13,129.5	1,019	1,353	148.8	116	236	26.0
	2003	2,756	5,654	1,074.3	105,711	64,126	7,695.1	2,260	2,297	252.7	1,736	3,103	62.1
Idaho Totals	2002	52,768	97,686	27,222.1	111,939	130,400	26,025.2	52,846	60,082	6,609.1	21,930	54,954	6,045.1
	2003	49,157	159,352	13,857.5	152,058	121,760	17,608.9	67,287	110,403	12,093.1	32,147	80,850	1,623.5

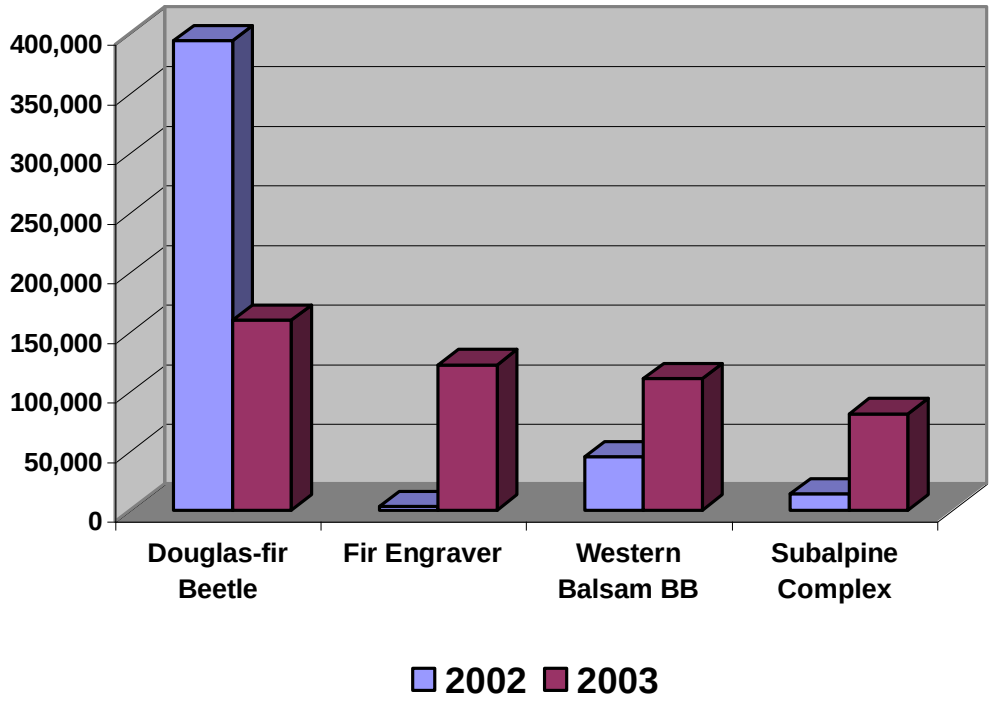

Figure 3. Aerial Detection Survey (ADS) Douglas fir, grand fir, and subalpine fir mortality (red trees) by Bark Beetle Species in Idaho 2002 – 2003.

DEFOLIATORS

Larch Casebearer

Neither aerial nor ground surveys detected larch casebearer-caused defoliation in northern Idaho in 2003. The population that caused defoliation from 1997-2001 has continued to decline to current undetectable levels. Rates of parasitism during the outbreak were monitored each year, but population levels of parasites were not high enough to exclusively account for the population decline. Other causes for the decline of larch casebearer populations were not determined. Affected areas in 1997-2001 will be occasionally monitored for a resurgence of larch casebearer populations; but detectable defoliation in 2004 is unlikely.

Western Spruce Budworm

In northern Idaho, a complex of 5 budworm (*Choristoneura*) species including western spruce budworm (*Choristoneura occidentalis* Freeman) was responsible for 18,500 acres of defolation in 2003, up from 6,900 acres defoliated detected in 2002 ADS. Most budworm defoliation occurred on the **Kaniksu NF** across landscapes west and north of Priest and Upper Priest Lakes and along drainages of Lightning Creek**,** with budworm feeding heavily on hemlock. This is a rare occurrence, as budworm-caused hemlock defoliation has not been recorded since 1922.

Most of the budworm defoliation in southern Idaho in 2003 was concentrated on the **Boise** and **Caribou-Targhee NF's**, and has increased significantly over 2002 levels. Budworm defoliation in southern Idaho is on its favored hosts: Douglas-fir and grand fir. Varying amounts of defoliation were recorded across landscapes of the North Fork Range and Salmon River Mountains on the **Boise NF**, as well as the

Centennial and Beaverhead Mountains on the **Caribou-Targhee NF**. If weather conditions remain within the normal range or are warmer and drier during 2004, we can expect budworm populations to increase.

Western Hemlock Looper

The western hemlock looper infestation that caused thousands of acres of defoliation in 2001 and 2002 (38,000 and 53,440 acres respectively) on the **Clearwater** and **Nez Perce NF's** in northern Idaho appears to have abated. This year, only 24 acres of hemlock looper defoliation was mapped on Forest Service land on the **Clearwater NF**. Western hemlock looper outbreaks typically last 3 years. Parasites, predators, and disease are the primary causes of their demise.

Douglas-fir Tussock Moth

In northern Idaho, defoliation from DFTM decreased from 5,400 acres in 2002, to zero in 2003. This recent outbreak was the second that has occurred in the past 20 years (fig. 4). Pheromone trap catches decreased from an average of 71 male moths/trap in 2001 to 0.2 moths/trap for this year. This followed an outbreak of DFTM in Idaho that peaked in 2000, and resulted in several spray projects conducted by the IDL in 2001 and 2002 on mixed land ownerships within the **Clearwater NF**. Nearly 2,400 acres were defoliated on Districts within the **Sawtooth NF** in southern Idaho during that time.

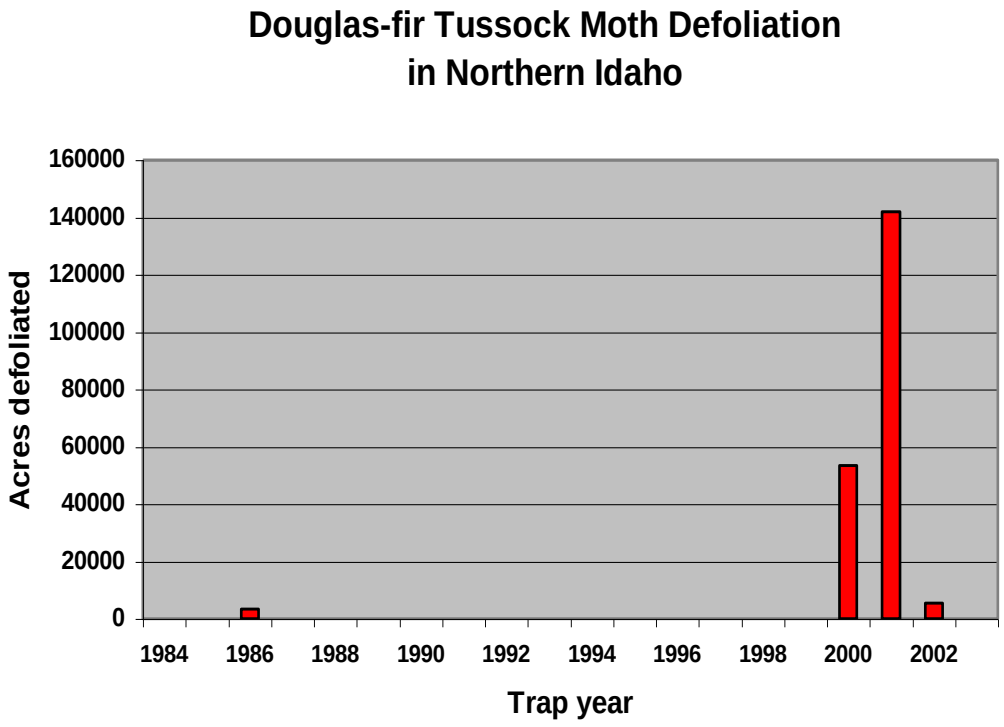

Figure 4. Defoliated acres by Douglas-fir tussock moth as determined by ADS in northern Idaho 1984-2003.

Table 5. Douglas-fir tussock moth Early Warning System Pheromone Trap Results: Means of average moth catch per 5 pheromone trap/sample plots in Idaho, **2003-1993**

AREA	Number of 200 sample plots	2003	2002	2001	2000	1999	1998	1997	1996	1995	1994	1993
STATE AND PRIVATE												
Coeur d'Alene	5	*	0.0	0.0	0.0	0.6	0.3	0.08	0.0	0.0	0.0	0.0
Coeur d'Alene	5	*	0.0	0.0	0.0	0.5	0.08	0.0	0.0	0.0	0.0	0.0
Plummer-Moscow	13	0.3	33.9	73.5	75.2	36.6	20.4	4.1	0.4	0.3	0.02	0.1
Plummer-Moscow	18	0.6	43.9	82.9	63.3	24.0	14.0	1.2	0. 1	0.04	0.0	0.0
Plummer-Moscow	13	0.1	31.4	87.2	55.9	19.0	2.6	0.1	0.0	0.0	0.0	0.0
Plummer-Moscow	1	0.2	1.0	0.2	93.0	36.4	29.8	1.4	0.2	0.2	0.0	0.0
Plummer-Moscow	2	0.4	37.9	79.1	89.4	44.1	54.8	2.7	0.2	0.1	0.0	0.0
Plummer-Moscow	3	1.3	62.1	80.1	96.1	55.6	29.7	2.2	0.3	0. 1	0.0	0.0
Plummer-Moscow	15	0.2	30.8	72.7	82.4	69.7	30.1	7.8	1.4	0.04	0.0	0.0
Plummer-Moscow	1	0.0	8.8	75.4	*	37.6	20.2	0.4	0.0	0.0		
Plummer-Moscow	3	0.5	47.7	38.9	97.1	67.1	52.1	3.1				
Plummer-Moscow	2	0.1	15.5	39.1	86.8	53.0						
Plummer-Moscow	27	0.01	27.4	68.7								
Plummer-Moscow	24	0.01	22.1	66.3								
Craig Mountain	7	0.0	0.1	6.4	0.0	0.6	0.5	0.0	0.0	0.0	0.0	0.05
NEZ PERCE NF												
Moose Ck RD	4	0.3	0.8	2.0	1.0	2.4	1.7	0.0	0.0	0.0	0.0	0.04
Salmon River RD	5	0.0	0.1	2.2	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.08
CLEARWATER NF												
Lochsa RD	2	0.0	0.4	5.9	*	0.0	0.4	0.0	0.0	0.0	0.0	0.0
North Fork RD	3	1.3	0.3	15.1	0.8	1.9	2.6	0.0	0.0	0.0	0.0	0.0
Pierce RD	6	0.0	3.6	16.9	1.0	0.4	0.3	0.0	0.0	0.0	0.0	0.0
Palouse RD	6	6.7	32.9									
BOISE NF												
Mountain Home	6	*	5.9	17.4	15.4	3.8	0.1	0.5	2.1	0.0	0.1	0.0
RD	8	*	1.0	3.4	0.8	0.2	0.0	0.0	0.0	0.0	0.0	0.0
Idaho City RD	5	*	0.0	0.4	0.2	0.2	0.04	0.0	0.0	0.0	0.0	0.0
Cascade RD	9	*	0.1	0.7	0.4	0.0	0.1	0.0	0.0	0.0	0.0	0.0
Lowman RD	10	*	0.5	5.1	6.9	6.8	3.0	0.3	0.02	0.0	0.0	0.02
Emmett RD												
PAYETTE NF												
Council RD	11	*	1.2	6.4	15.8	13.1	5.8	1.4	0.05	0.1	0.0	0.0
Weiser RD	12	*	3.3	11.9	19.0	29.9	26.9	3.6	0.6	0.1	0.1	0.0
New Meadows RD	11	*	0.2	5.5	9.8	9.3	5.3	0.6	0.02	0.0	0.0	0.0
McCall RD	5	*	0.1	2.0	2.7	1.7	0.6	0.0	0.0	0.0	0.0	0.0
SAWTOOTH NF												
Burley RD	2	*	3.6	20.2								
Fairfield RD	5	*	1.1	9.3	9.0	1.7	0.5	0.08	0.1	0.0	0.3	0.0
OTHER												
Owyhee	3	*	6.1	57.5	84.6	40.2	32.1	30.6	24.0	13.1	2.0	0.0
Mountains	1	*	50.2	38.2	29.6	12.8	*	0.4	0.0	0.0	0.0	0.0
Sharps Canyon												

* Traps not deployed

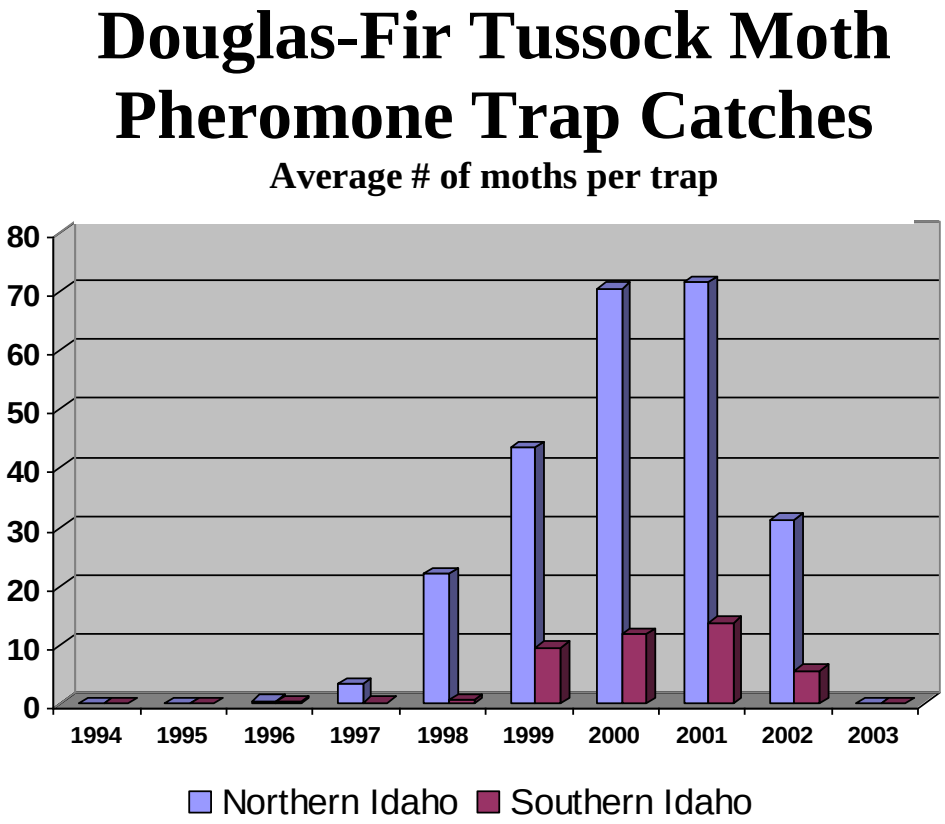

Figure 5. Douglas-fir Tussock Moth Early Warning System trap results (average # of moths per trap) 1994-2003. Douglas-fir tussock moth early warning system traps maintained in Idaho by the Idaho Department of Lands (IDL) and the United States Department of Agriculture Forest Service Forest Health Protection Staff.

Gypsy Moth

The Idaho gypsy moth detection survey program systematically samples all populated areas of the State in order to detect introductions of gypsy moths. Many USDA Forest Service campgrounds are sampled, as well as rest stops, tourist attraction sites, and other locations where people congregate. High-risk areas, those cities with the highest populations and the highest potential for newly arriving families are trapped each year. Other areas are trapped every other year or every third year. The survey will continue to expand as cities grow and more people move into the rural areas of the state. All trapping results are incorporated into the National Agricultural Pest Information System (NAPIS) database.

DETECTION TRAPPING

In 2003 the cooperating agencies in the Idaho gypsy moth detection program placed 5,582 detection traps throughout the state. Pheromone-baited traps were placed on a grid basis at a density of four traps per square mile. Traps were placed throughout the state in cities and towns and the surrounding urban areas and rural communities in accordance with a predetermined rotation schedule. Cities and communities where 20 or more move-ins occurred are trapped irrespective of their place in the schedule. A move-in is defined as an individual or family moving to Idaho from a state that is generally infested with gypsy moths. This information is derived from vehicle registration information supplied by the Idaho Department of Transportation. Most infestations are initiated when an egg mass or other life stage of the gypsy moth arrives on an outdoor household article brought by someone moving into the area. Between May 2001 and April 2002, there were 5,188 “move-ins” to the state, representing an 8.2% increase over

the previous year. Between May 2002 and April 2003, documented "move-ins" totaled 10,195, nearly doubling the amount over the previous year. Campgrounds, tourist attractions, and other high-risk locations were also trapped.

DELIMITATION TRAPPING
Delimitation traps are only placed if there has been a confirmed gypsy moth catch in the area the previous year. Delimitation traps were placed at 2 locations in 2003. At Blanchard, north of Spirit Lake in Bonner County, 19 delimitation traps were placed surrounding the capture site of a single male moth in 2001. At Thornton, between Rexburg in Madison County, 16 delimitation traps were placed surrounding the capture site of a single male moth in 2001. Delimitation traps at both locations were placed at a density of 16 traps/mi².

MASS TRAPPING
In 2003, no mass trapping occurred in Idaho.

No gypsy moths were captured in Idaho in 2003.

STATE ADVISORY COMMITTEE
An advisory committee, composed of representatives from the Idaho Department of Lands, The Idaho Department of Agriculture, The U. S. Forest Service Regions 1 and 4, and APHIS, reviews activities and provides guidelines for the gypsy moth program in Idaho.

OTHER INSECTS

Balsam Woolly Adelgid

Balsam woolly adelgid (BWA), a non-native invasive from Europe, was first detected in Idaho in 1983 near Coeur d'Alene. This near-microscopic insect is capable of killing true fir (*Abies* spp.) trees. The host range includes native grand fir and subalpine firs along with white firs planted in landscape settings. Since establishment, the insect's host range in Idaho had been restricted to a roughly 250-mile band in northern Idaho between the Salmon and St. Joe Rivers. In 2001 the sap-sucking insect was found killing four subalpine firs in residential settings in Cascade and McCall, Idaho.

Aerial survey data estimate 24,500 acres infested by BWA in northern Idaho in 2003. This number is in sharp contrast from the 85,400 acres recorded by aerial survey in 2002. The decrease is likely due to a reduction in the area surveyed in 2003 over 2002 and not to a decline in the BWA population or distribution in the Region. Aerial surveys reported 85,400-acres infested in 2002, 51,000-acres infested in 2001, and 56,400-acres infested in 2000. The number of acres infested likely exceeds all of these numbers since some areas may not yet be displaying crown symptoms. Areas with the heaviest infestations occurred on the **St. Joe**, **Clearwater**, and **Nez Perce NF's**, along with adjacent State, private, and BLM lands. Subalpine fir of all ages and size classes are killed. Extensive gouting and bole infestations occur on grand fir, but to date no grand fir over 5 inches in diameter has been documented as being killed solely by the adelgid. Regeneration mortality of both subalpine and grand fir is high, resulting in forest type conversions in some areas. Continued surveys to delimit the distribution of the balsam woolly adelgid and damage assessment surveys are planned in the near future.

Cone and Seed Insects

Cone and seed insects can cause considerable damage to the seeds of western conifers, significantly reducing seed crops. Though insects are found feeding on a variety of tree species in wild stands, they are especially of concern in blister rust-resistant western white pine seed orchards. The insects that cause the most damage in western white pine are western conifer seed bug, *Leptoglossus occidentalis*, cone beetle,

Conophthorus ponderosae, and coneworm, *Dioryctria abietivorella*. One or more of these insects are often abundant enough in northern Idaho white pine seed orchards to warrant an insecticidal spray treatment to protect cones. Cone beetles have caused significant cone mortality at the Grouse Creek Tree Improvement Area in northern Idaho for the past few years. A small test of the behavior chemical 4aa (microencapsulated 4-allylanisol) was conducted this year in cooperation with Forest Insect and Disease research, with promising results. A larger treatment of 4aa is planned for 2004.

Tree improvement areas in Montana are now nearing cone-producing age. Monitoring will occur as cones are produced.

FOREST DISEASES

STEM AND BRANCH DISEASES

Comandra blister rust

This disease occurs infrequently on lodgepole and ponderosa pine throughout Idaho. Localized areas of heavy infection resulting in branch, top and entire tree mortality of sapling-size ponderosa pine occurs in offsite plantations in southern Idaho.

Dutch elm disease

In Idaho this disease is common in many communities along the Snake River in southern Idaho, and is slowly working its way into northern Idaho communities. It was discovered in Moscow in 1990, but an aggressive treatment program has limited losses to only a few trees per year for the past several years. It has also been discovered in several communities nearby--Genesee, in Idaho; Palouse and Pullman, in Washington.

Pinyon blister rust

This disease occurs on pinyon pine in the Raft River Mountains on the Sawtooth NF in central Idaho. Disease levels are generally sporadic and tree mortality is low.

Stalactiform blister rust

This rust disease occurs on lodgepole pine in localized areas throughout Idaho. Severe infection has occurred in localized areas on the Boise, Payette, Sawtooth and Targhee NF's.

Western gall rust

This disease occurs throughout the range of lodgepole and ponderosa pine in Idaho. Disease levels vary from year to year and some sites are more prone to damage from this disease than others. Genetic resistance varies widely and resistant individuals can often be found in locations with high infection levels. Generally the disease is not an important cause of mortality, although branch and stem breakage can be of concern, especially within recreation areas. Gall rust is an important consideration in tree improvement plantations where infection can significantly affect performance of young trees. It has also been found damaging ornamental pines including Scots, Austrian and mugho.

White pine blister rust

White pine blister rust was introduced into western North America around 1910, and subsequently spread to western white pine, whitebark pine, and limber pine in Idaho and other western forests. This disease, along with bark beetles, fire suppression, and logging resulted in reducing white pine dominated stands to less than 5% of the 5 million acres where it once was the dominant species. White pine blister rust continues to kill seedlings that naturally regenerate from remaining white pine trees, and, in collaboration with mountain pine beetle, continues to kill residual mature trees. This has resulted in major changes in historical transitions in forest types over broad areas. Western white pine has historically been the dominant species in moist habitat types of northern Idaho, but has been replaced by species such as grand fir, Douglas-fir, and hemlock. These tree species are more susceptible to native disturbances such as bark beetles and root diseases. Efforts to restore white pine are concentrating on planting stock with improved resistance. Current monitoring efforts are focused on gaining a better understanding of improved stock performance over time. In addition, lower branch pruning of younger trees is being conducted on a large scale in certain areas to improve survival rates.

White pine blister rust is also causing extensive mortality in high-elevation five-needle pines. Recent surveys in northern Idaho and western Montana high-elevation forests have found infection rates in whitebark pine regeneration of up to 90%. There is a growing concern that severe losses of large diameter whitebark pine due to bark beetles coupled with regeneration losses due to blister rust may have significant impacts on water and wildlife in these fragile ecosystems.

CANKER DISEASES

Atropellis canker

This disease occurs on lodgepole pine and is usually found in groups of pole-sized trees. This disease primarily causes stem defects and topkill; tree mortality is infrequent. The disease is most common in southern Idaho, but can be found sporadically across the entire state.

Cytospora canker of true firs

This disease has been found throughout the state on all *Abies* spp. Infected trees display branch flagging, top killing, and infrequent mortality. The disease is associated with environmental stresses such as drought, frost, and freezing damage. Severely infected subalpine fir may be killed by the western balsam bark beetle.

Sphaeropsis blight

This disease is very common on ponderosa pine in many areas throughout Idaho. Damage occurs primarily as a branch or main stem dieback with dead branch tips especially common on exposed portions of tree crowns. Affected trees are often found in riparian areas, although damage can occur on the edges of any ponderosa pine stand. Apparently, disease severity is cyclic and associated with years of prolonged cool, wet weather. This disease does not normally cause tree mortality (except in nursery seedlings) but results in trees with dieback symptoms that may be especially unsightly in recreational and residential areas.

STEM DECAYS

Aspen trunk rot

Decay caused by this fungus occurs most frequently in aspen stands in southern Idaho; damage seems to increase in stands 80 years and older.

Indian Paint fungus (Rust Red stringy rot)

This fungus is an important cause of heartwood decay of hemlock and *Abies* spp. It causes more than 90% of the decay occurring in these species and is especially damaging in trees older than 60 years. The most extensive damage is usually found in stands with multiple entries. In northern Idaho stands with prolonged periods of cool, wet conditions, usually have the most damage but in southern Idaho decay caused by this fungus is also common in mature and overmature stands of *Abies* spp. in much drier climates.

Red ring rot (White pocket rot)

This fungus causes white pocket decay of heartwood in western larch and all pine species. It occurs less frequently on spruce, Douglas-fir and *Abies* spp. Damage levels vary considerably throughout Idaho. Cavity nesters often use mature trees with advanced decay.

ROOT DISEASES

Douglas-fir and *Abies* spp. are the primary hosts of root diseases. These species have increased dramatically during the past several decades due to the loss of western white pine, western larch and ponderosa pine from blister rust, fire control, logging and forest practices such as thinning that favor shade tolerant species. As a result, root diseases have become the most important diseases in northern Idaho. The most important root pathogens are *Phellinus weirii* (cause of laminated root disease) and *Armillaria ostoyae* (cause of Armillaria root disease). Many root pathogens are intimately associated with insects (particularly bark beetles) either as vectors or agents that attack and often kill infected trees. Therefore, mortality levels may vary from year to year in response to bark beetle activity.

Annosum root disease

Annosum root disease is separated into two types based on the hosts attacked. The “p-type” attacks pines and is common in ponderosa pine stands in western Montana. Infected trees are frequently found near stumps, which serve as inoculum sources. Importance, distribution, and impact of this root disease vary widely throughout Idaho. Most damage is concentrated in lower elevations where ponderosa pine is the dominant tree species and past harvesting of large trees has been common. Presence of annosum root disease in ponderosa pine stands greatly decreases the potential for managing ponderosa pine. These sites are usually too dry to effectively grow alternative tree species, so preventing the introduction and subsequent increase of annosum root disease is crucial for managing ponderosa pine. The “s-type” of Annosum root disease is widespread at low levels on Douglas-fir and true firs in mixed conifer stands throughout western Montana and northern Idaho. It is frequently found in association with other root diseases.

Armillaria root disease

This pathogen is the most broadly distributed of the root pathogens and the most important disease agent, overall. It frequently occurs in conjunction with annosum root disease, laminated root rot, or brown cubical root and butt rot. *Armillaria* can kill conifers of all species when they are young, but only Douglas-fir, subalpine fir and grand fir remain highly susceptible throughout their lives. Consequently, the damage is much greater in the latter species where severe disease often turns formerly forested sites into permanent shrub fields.

Black stain root disease

Black stain root disease is found infrequently in Idaho. The pathogen may cause pinyon pine mortality (associated with insect attacks) in southern Idaho and occurs on off-site ponderosa pine in some stands in northern Idaho. The fungus is vectored by root-feeding insects and infected trees are usually attacked and killed by bark beetles.

Brown butt rot

Phaeolus schweinitzii causes brown-cubical decay of roots and butts of Douglas-fir and pine species (particularly ponderosa pine). This fungus is a common root inhabitant of Douglas-fir trees of all ages, but causes root decay mostly in mature trees. Trees on poor sites (shallow soils with poor water-holding capacity) are especially prone to damage by this fungus. Infected trees are rarely directly killed by this fungus, but may be predisposed to windthrow and bark beetle attacks.

Laminated root disease

This root pathogen is a major cause of mortality of Douglas-fir and *Abies* spp. in northern Idaho. Losses in some areas are extensive, although distribution of the pathogen within forests varies widely. Some level of disease-associated mortality occurs each year with greater mortality occurring during years of drought stress or high bark beetle populations.

This disease is most severe on sites that historically may have supported mostly western white pine and western larch. These tree species have been replaced by highly susceptible Douglas-fir, grand fir and subalpine fir with consequent increases in this pathogen. It causes damage to trees of all ages, primarily in distinct groups or pockets. This pathogen is often found in conjunction with *Armillaria* and/or annosum root disease, and like *Armillaria*, often converts formerly forested sites to long-term shrub fields.

Tomentosus root disease

This disease occurs on Douglas-fir, subalpine fir, Engelmann spruce and lodgepole pine. The pathogen usually causes root and butt decay, often in association with other root-infecting fungi. Infected pole-sized or larger trees may have increased susceptibility to bark beetle attack and windthrow. The pathogen is most common in southern Idaho, but occurs at low levels throughout the state.

White mottled rot

This root pathogen of aspen is increasing throughout southern Idaho. The disease is frequently found on windthrown trees on the Caribou and Sawtooth NF's.

DWARF MISTLETOES

Dwarf mistletoes are parasitic seed plants in the genus *Arceuthobium.* They occur on most conifer species in Idaho, especially Douglas-fir, western larch, ponderosa and lodgepole pine. Western larch overstory trees throughout many stands in northern Idaho are extensively infected with dwarf mistletoe. Douglas-fir and ponderosa pine are infected only in particular stands in northern Idaho. Lodgepole pine dwarf mistletoe suppression projects have continued to remove infected overstory trees. However, dwarf mistletoes remain very widespread and are probably are the most damaging disease in southern Idaho.
Lodgepole pine dwarf mistletoe is especially damaging in southern Idaho, and infests approximately 2 million acres (28 percent) of the lodgepole pine type in Region 1 causing about 18 million cubic feet of growth reduction annually. Douglas-fir dwarf mistletoe infests about .6 million acres (13 percent) of Douglas-fir forests, reducing growth by approximately 13 million cubic feet annually. Western larch dwarf mistletoe occurs on about .8 million acres (38 percent) of western larch stands, and reduces annual growth by over 15 million cubic feet. Ponderosa pine dwarf mistletoe is prevalent throughout its host range in southern Idaho and is locally heavy in ponderosa pine stands around Coeur d'Alene and along the Spokane River drainage in northern Idaho. Limber pine and whitebark pine are heavily infected in localized areas in Montana, with infection being most prevalent east of the Continental Divide.

FOLIAGE DISEASES

All conifer species are susceptible to foliage diseases but damage varies from year to year. Foliage diseases are usually favored by high moisture conditions, so damage is typically most severe in dense stands and in the lower portions of crowns. Infections generally occur during moist periods in the summer or fall, but damage may not be observed until needles are killed the following spring. Since most foliage diseases only attack one age class of needles, they very rarely cause tree mortality, but several years of infection may result in reduced growth. However, they may be important problems in Christmas tree and tree improvement plantations where healthy foliage is required. In these cases, direct suppression with fungicides is often warranted.

Elytroderma needlecast

This foliage disease actually grows into small branches where it can perpetuate the disease year after year. In 1996, high levels of infection were noticed throughout many stands in Idaho. Infection was especially severe on the Salmon NF where foliage discoloration was noted on more than 9500 acres. In 1997 and 1998, relatively high levels of infection again occurred throughout the state. Localized areas of heavy infection from Elytroderma were seen in Montana in 1999. Elytroderma has been severe in several areas of western Montana for a number of years, but several new heavily infected areas were reported in 1998 and 1999. This apparent increase in Elytroderma indicates that favorable weather conditions for infection probably occurred during the summers of 1997 and 1998.

Lodgepole pine needlecast

Lophodermella concolor causes cyclic damage on lodgepole pine throughout Idaho. In southern Idaho, the disease appears following periods of drought. In northern Idaho, extensive damage is evident in the early spring in some stands. Damage varies from year to year and it is difficult to predict future disease levels based on observations of spring weather conditions. High levels of infection make trees appear extensively damaged. However, the disease usually has no prolonged effects on infected trees although growth may be temporarily reduced. An exception is in tree improvement plantations where growth reductions seriously affect tree performance.

Rhabdocline needlecast

This disease occurs on young Douglas-fir throughout Idaho; it is particularly noticeable in some stands in northern Idaho and may cause extensive defoliation on young trees. Christmas tree production has been greatly reduced or eliminated in certain parts of northern Idaho because of this disease.

Swiss needlecast

This is another foliage disease of Douglas-fir that occurs throughout northern Idaho. In recent years, infection levels have increased, probably because of increasing fungal inoculum and conducive spring weather. Affected trees may have chlorotic thinning crowns as foliage is slowly killed and needle retention is reduced.

Larch needle disease

Larch needlecast is caused by *Meria laricis* and needleblight is caused by *Hypodermella laricis*. Both diseases are generally cyclical, occurring at high levels during years of prolonged cool, moist weather in the spring and early summer. In 1996, these diseases were epidemic throughout central Idaho; apparently associated with a late June frost. More than 88,000 acres were damaged on the Payette NF and northern portions of the Boise NF. However, disease incidence in 1997 and 1998 declined, primarily due to increased defoliation by larch casebearer.

Fir broom rust

This disease is widespread on *Abies spp*. throughout Idaho. Although the disease is usually of little consequence, high disease levels occur in some stands south of the Snake River in southern Idaho.

Spruce broom rust

This disease is scattered throughout spruce stands in Idaho. It appears most commonly in spruce stands in eastern Idaho.

Cedar apple rust (Gymnosporangium rusts)

In eastern Idaho, this disease causes a leaf spot on residential apple trees in Challis and Salmon, Idaho and on *Amelanchier* spp. throughout the range of serviceberry in eastern Idaho.

Conifer-aspen rust and conifer-cottonwood rust

In 1996, an epidemic of this rust disease occurred throughout the range of *Populus* spp. in southern Idaho. In 1997, the fungus was not observed on its main conifer host (Douglas-fir); it is possible that the fungus overwintered on its *Populus* hosts due to mild winters. In 1998, disease occurrence was light, probably because of competition with other foliage diseases related to late frosts.

Miscellaneous foliage diseases

Fir needlecast on subalpine and grand fir occurred at low levels from 1996-1998 throughout Idaho. Ponderosa pine needle rust occurred at light to moderate levels. Red band needle blight remained at fairly high intensity on ponderosa pine in some locations, such as along the Lochsa River in northern Idaho.

White pine needlecast has declined dramatically during the past few years. Marssonina blight and Shepard's Crook occurred at epidemic proportions on aspen during 1996-1998 in central and eastern Idaho. Affected trees had brown-colored foliage from mid-July until leaf drop in the fall.

NURSERY DISEASES

Fusarium root disease

The most important pathogens affecting both bareroot and container nurseries in Idaho are species of *Fusarium,* which cause damping-off and root diseases of young seedlings. In 2003, *F. oxysporum* was the most common species found in bareroot stock, while *F. proliferatum* was most commonly found in container stock. Although these diseases did not cause extensive damage in nurseries, endemic levels commonly occurred. Other *Fusarium* spp. found in nursery stock include *F. solani, F. sporotrichioides, F. avenaceum, F. acumination,* and *F. sambucinum.* Additional *Fusarium* spp. may be isolated from diseased seedlings, but are probably either saprophytes or very weak pathogens. Most growers controlled bare root diseases by pre-plant soil fumigation and container diseases by reductions in pathogen inoculum and timely applications of pesticides.

Cylindrocarpon root disease

Cylindrocarpon destructans causes root disease of container-grown five-needle pines (western white pine, whitebark pine). The pathogen typically causes at least low levels of root decay, which often lacks above-ground disease symptoms on affected seedlings. Growers have successfully managed this disease by implementing container sterilization, seed treatments, periodic fungicide applications, appropriate watering schedules, and the use of well-drained growing media. This has resulted in a decrease in damage to container-grown western white and whitebark pine in 2003 compared to prior years.

Gray mold

Botrytis cinerea is an important disease of container-grown western larch, Engelmann spruce, western red cedar, and western white pine seedlings in our Region 1 container nurseries. This disease is best prevented by careful monitoring and sanitation procedures. When discovered, fungicide applications utilizing alternating chemicals are implemented. *Botrytis* can also cause important damage to cold-stored seedlings after lifting and prior to outplanting. Storing seedlings at below-freezing temperatures and rapidly thawing them prior to outplanting restricts pathogen development. Normal, endemic levels of damage were reported for 2003 as growers reported the success of existing fungicides to control this important pathogen.

Tip dieback

Tip dieback caused by *Sirococcus conigenus, Spaeropsis sapinea, and Phoma* spp. occurred at normal levels. Fungicide applications are applied, and usually effective in limiting disease buildup during the spring.

Other Diseases

Meria laricis on bare root western larch occurred at low levels. Root diseases caused by *Pythium* spp. or other soilborne pathogens were also detected at average levels. Most of these pathogens are easily detected during most years, but their level of intensity is often related to ambient weather conditions, especially intensity and duration of rainfall. During years of unusually wet spring and summer weather, these diseases are more severe; such was not the case during 2003.

NURSERY DISEASE PROJECTS

Work to evaluate potential alternatives to chemical pre-plant soil fumigation was completed at the Lone Peak Conservation Nursery in Draper, Utah. Chloropicrin alone was as effective as the standard mixture of methyl bromide/chloropicrin in controlling soilborne pathogens and its use resulted in production of high-quality bitterbrush seedlings. Bare fallowing with periodic cultivation was not as effective because soilborne pathogen populations remained high throughout the growing season. Since chloropicrin does not effectively control weeds, use of this chemical as a pre-plant treatment will require additional herbicide treatments.

Efforts have continued to develop alternative methods to sterilize used styrofoam containers, and to reduce soilborne pathogens in forest nursery soil at the Missoula Technology & Development Center. The goal is to develop cost-effective alternatives to currently used techniques of disease control. Radio frequency waves and dry heat ovens have shown promise in sterilizing containers. Infrared treatment of nursery soil may effectively control soilborne pathogens. Work will continue to improve treatment techniques and develop appropriate equipment.

Tests to evaluate the biocontrol agent *Trichoderma harzianum* were completed at several container nurseries in the western United States. The goal was to use a commercially available formulation of this agent [Biotrek®] to control *Fusarium* diseases of container stock. Tests were completed during the 2003 growing season and data is currently being analyzed.

Fusarium oxysporum is the most important and damaging pathogen of forest nurseries in western North America. Efforts were initiated in 2003 [in cooperation with the Rocky Mountain Research Station] to genetically define populations of this species from forest nurseries [determine genetic diversity and phylogeny] and to locate molecular markers that could be used to separate pathogenic from non-pathogenic isolates. Initial work indicated that pathogens may be separated from non-pathogens using amplified fragment length polymorphism [AFLP] and DNA sequencing techniques. Work will continue to develop molecular probes that may be used to detect pathogenic populations in the field.

STATUS OF CHRONIC DISEASE PROBLEMS		
DISEASE	**HOST**	**LOCATION/REMARKS**
STEM & BRANCH DISEASES		
Aspen trunk rot	Aspen	Decay occurs in most aspen stands in southern Idaho and is increasingly common as stands age exceeds 80 years.
Atropellis canker	Lodgepole pine	Found in pockets in pole sized stands causing defect, topkill, and some mortality.
Comandra blister rust	Lodgepole pine/ponderosa pine	Infection occurs infrequently throughout Idaho. Heavy, localized areas of infection resulting in branch, top, and entire tree mortality of sapling-size ponderosa pines occurs in offsite plantations on southern Idaho.
Cytospora canker	True firs	Branch flagging, top killing, and mortality attributed to this fungus occurs wherever hosts are found. This disease is associated with environmental stress damage, drought, frost, and freezing. Western balsam bark beetles frequently kill the diseased trees.
Sphaeropsis blight	Ponderosa pine	Is causing widespread branch dieback in many Idaho areas; especially common in riparian areas.
Dwarf mistletoes	Douglas fir, western larch, lodgepole and ponderosa pine	Suppression projects continue to remove infected overstory trees; however, this forest disease remains the most widespread and damaging throughout the state.
Indian paint fungus	True firs, hemlock	Causes 90 percent of decay in these species throughout the state; especially common as age increases beyond 60 years. Common in mature and overmature stands of true firs throughout southern Idaho
Pinyon blister rust	Pinyon pine	This disease occurs in the Raft River Mountains on the Sawtooth National Forest
Red ring rot	Western larch, true firs, Douglas-fir, Western larch, true firs, Douglas pines, spruce	Can cause serious decay problems in mature conifers. Infection intensity varies throughout host stands in southern Idaho.
Stalactiform blister rust	Lodgepole pine	This rust occurs in localized areas throughout the host type. Heavy infection has been in very localized areas of the Boise, Payette, Sawtooth, and Targhee NF's.
Western gall rust	Lodgepole and ponderosa pine	Gall rust occurs throughout the host types. Infection levels vary, with localized heavy infection present in both host species.
White pine blister rust	Western white pine, limber pine, whitebark pine	This introduced disease is common throughout its host ranges in Idaho. A formal survey of five-needled pines was conducted in 1995-1997 in southern Idaho to quantify disease incidence and intensity, and determine site and stand characteristics of infected areas.
ROOT DISEASES		
Annosus root disease	Pines, true firs, Douglas-fir, spruce	Causes mortality, root and butt rot especially in young trees near old stumps; frequently in complexes with other root diseases; may predispose trees to windthrow and/or bark beetles. This root disease fungus can be found on pines throughout southern Idaho and on firs and spruce in northern Idaho.
Armillaria root disease	Douglas-fir, grand fir, other conifers especially when young and improperly planted	In northern Idaho, a widespread killer of all sizes of trees; In southern Idaho usually found as a weak pathogen or saprophyte causing little direct mortality or in complexes with other root diseases.
Black stain root disease	Pines, Douglas-fir	Found infrequently in Idaho; caused pinyon pine mortality in southern Idaho; usually in association with other root diseases.
Laminated root rot	Douglas-fir, true firs, occasionally other conifers	Primary killer in many stands from the Nez Perce NF north; may be found with Armillaria or other root diseases.
Schweinitizii root rot	Douglas-fir, pines	This decay is common in mature and overmature forests throughout the host type, especially those with a frequent fire or logging history. The fungus is often associated with other root pathogens and bark beetle activity.
Tomentosus root disease	Douglas-fir, subalpine fir, Engelmann spruce, lodgepole pine	Usually found as root/butt rot with other root diseases; occasionally causes mortality. It causes root and butt rot of pole sized and larger trees, predisposing them to bark beetle attack and windthrow. Most common in southern Idaho, but present throughout the state.
White mottled rot	Aspen	This pathogen is increasing in incidence throughout southern Idaho. The disease can be found on windthrown aspen on the Caribou and Sawtooth National Forests.

FOLIAGE DISEASES		
Cedar apple rust	Juniper, Apple, Serviceberry	In eastern Idaho, this disease caused a leaf spot on residential apple trees in Challis and Salmon, ID and to *Amelanchier* throughout the range of serviceberry in eastern Idaho.
Conifer-Aspen rust Conifer-Cottonwood rust	Aspen, cottonwood, conifers	In 1996 epidemic throughout the host range of all *Populus* species. In 1997 the fungus has not been observed recently on main conifer host, Douglas-fir, so it may be overwintering on *Populus* due to mild winters. In 1998 occurrence was light due to late frost competition with other foliage diseases.
Rhabdocline needle casts	Douglas-fir	Very widespread but relatively light levels statewide.
Swiss needlecast	Douglas-fir	Widespread in northern Idaho; generally at very low levels of infection.
Elytroderma needlecast	Ponderosa pine	Systemic and annual infections occur throughout the host type. Infection was especially severe on the Salmon National Forest.
Fir broom rust	True firs	Widespread throughout the state; usually of little consequence, but is "extremely common" in stands south of the Snake River in southern Idaho.
Fir needlecast	Subalpine fir Grand fir	Infection occurred at low levels throughout the host type.
Fir needle rust	Subalpine fir	Scattered infection occurs on seedlings and sapling trees throughout the host type.
Larch needle disease	Larch	Incidence and severity of infection in west central Idaho is cyclical. Following a late frost in June, 1996 over 88,000 acres of damage was found on the Payette and northern Boise National Forest. In 1997 and 1998 these diseases were overshadowed by the larch casebearer.
Lodgepole pine needlecast	Lodgepole pine	Infection intensity is worse following periods of drought. During intervening years, the disease is of minor localized importance.
Marssonina blight Shepard's crook	Aspen	In 1996 -1998 the disease was epidemic in central and eastern Idaho. Affected trees had brown colored foliage from mid-July until leaf drop.
Pine needle rust	Pines	Scattered incidence of light to moderate intensity scattered throughout the host types in southern Idaho.
Spruce broom rust	Engelmann spruce	Scattered through host range; most common in eastern Idaho.
White pine needlecast	Western white pine	Infections declined dramatically in 1999-2000.
NURSERY DISEASES		
Cylindrocarpon	Western white pine whitebark pine	Common in soil or contaminated containers, usually a saprophyte but may be a weak parasite, caused losses at several nurseries.
Diplodia tip blight	Pines	Low levels in areas with a history of problems.
Fusarium root disease	Douglas-fir, larch, spruce, others	The most common and widespread nursery disease; amount of damage varies widely. This disease causes small amounts of mortality primarily of 1-0 conifer seedlings at the Lucky Peak Nursery in Southern Idaho.
Grey mold	most conifers, esp. larch, spruce	Common at low levels in many nurseries. Can be a serious problem during seedling storage.
Meria needlecast	Larch	Infection levels are low on bare root western larch.
Phoma blight	Pines	Commonly isolated from seedlings and soil samples.
Phytophthora/Pythium root rot		These fungi occur infrequently on seedlings and in soil at Lucky Peak Nursery in southern Idaho. Infection results in patch mortality and culling of 2-0 seedlings.
Sirococcus tip blight	Spruce, Pines	Found at average levels at several nurseries.

COMMON AND SCIENTIFIC NAMES OF INSECTS

Balsam woolly adelgid	*Adelges picea* (Ratzburg)
Black-headed budworm	*Acleris gloverana* (Walsingham)
Boxelder leafroller	*Caloptilia negundella* (Chambers)
California five-spined Ips	*Ips paraconfusus* (Lanier)
Cone feeding adelgid	*Pineus coloradensis* (Gillette)
Cone moth	*Eucosma recissoriana* (Heinrich)
Cone worms	*Dioryctria* spp.
Cranberry girdler moth	*Chrysoteuchia topiaria* (Zeller)
Douglas-fir beetle	*Dendroctonus pseudotsugae* (Hopkins)
Douglas-fir tussock moth	*Orgyia pseudotsugata* (McDunnough)
Fir engraver	*Scolytus ventralis* (LeConte)
Gypsy moth	*Lymantria dispar* (L.)
Larch casebearer	Coleophora laricella (Hubner)
Lodgepole terminal weevil	*Pissodes terminalis* (Hopping)
Lodgepole needleminer	*Coleotechnites milleri* (Busck)
Mountain pine beetle	*Dendroctonus ponderosae* (Hopkins)
Pine engraver	*Ips pini* (Say)
Pine needle sheath miner	*Zelleria haimbachi* (Busck)
Red turpentine beetle	*Dendroctonous valens* (Le Conte)
Rusty tussock moth	*Orgyia antiqua* (L.)
Spruce beetle	*Dendroctonus rufipennis* (Kirby)
Tip moth	*Rhyacionia zozara* (Kearfott)
Western balsam bark beetle	*Dryocoetes confusus* (Swaine)
Western conifer seedbug	*Leptoglossus occidentalis* (Heidmann)
Western hemlock looper	Lambdina fiscellaria lugubrosa (Hulst)
Western pine beetle	*Dendroctonus brevicomis* (LeConte)
Western pine shootborer	*Eucosma sonomana* (Kearfott)
Western spruce budworm	*Choristoneura occidentalis* (Freeman)

COMMON AND SCIENTIFIC NAMES OF DISEASES

Annosus root disease	*Heterobasidion annosum* (Fr.) Bref.
Armillaria root disease	*Armillaria ostoyae* (Romagn.) Herink
Atropellis canker	*Atropellis piniphila* (Weir) L. & H.
Black stain root disease	*Leptographium wagneri* (Kendr.) Wingf.
Brown cubical butt rot	*Phaeolus schweinitzii* (Fr.) Pat.
Comandra blister rust	*Cronartium comandrae* Pk.
Conifer-aspen rust	*Melampsora medusae* Thum.
Conifer-cottonwood rust	*Melampsora occidentalis* Jacks.
Cylindrocarpon root disease	*Cylindrocarpon* spp.
Cytospora canker of firs	*Cytospora abietis* Sacc.
Diplodia tip blight	*Sphaeropsis sapinea* (Fr.) Dyko
Dutch elm disease	*Ophiostoma ulmi* (Buism.) Nannf.
Dwarf mistletoes	*Arceuthobium* spp.
Elytroderma needlecast	*Elytroderma deformans* (Weir) Dark.
Fir broom rust	*Melampsorella caryophyllacearum* Schroet.
Fir needlecast	*Lirula abietis-concoloris* (Mayr:Dearn) Darker
Fir needle rust	*Pucciniastrum epilobii* Otth
Fusarium root disease	*Fusarium* spp.
Grey mold	*Botrytis cinerea* Pers. ex Fr.
Indian paint fungus	*Echinodontium tinctorium* (Ell.& Ev.)Ell.& Ev.
Laminated root rot	*Phellinus weirii* (Murr.) Gilb.
Larch needle blight	*Hypodermella laricis* Tub.
Larch needlecast	*Meria laricis* Vuill.
Lodgepole pine needlecast	*Lophodermella concolor* (Dearn.) Dark.
Marssonina blight	*Marssonina populi* (Lib.) Magn.
Phoma blight	*Phoma* spp.
Pine needle rust	*Coleosporium sp.*
Pythium root disease	*Pythium ultimum* Trow.
Red ring rot	*Phellinus pini* Pilat.
Rhabdocline needle cast	*Rhabdocline pseudotsugae* Syd.
Rust Red Stringy Rot	*Rhabdocline weirii* Parker & Reid
Schweinitzii root/butt rot	*Phaeolus schweinitzii* (Fr.) Pat.

Shepard's crook	*Venturia macularis* (Fr.) E.Muller & Von Arx
Sirococcus tip blight	*Sirococcus strobilinus* Preuss.
Stalactiform rust	*Cronartium coleosporioides* (Diet. & Holw.) Arth.
Spruce broom rust	*Chrysomyxa arctostaphyli* Diet.
Spruce mottled needlecast	*Rhizosphaeria kalkhoffii* Bud.
Swiss needle cast	*Phaeocryptopus gaeumannii* (Rhode) Pet.
Tomentosus root rot	*Inonotus tomentosus* (Fr.) Gilb.
Western gall rust	*Endocronartium harknessii* (Moore) Hir.
White Mottled Rot	*Ganoderma applanatum* (Pers.) Pat.
White pine blister rust	*Cronartium ribicola* Fisch.
White pine needlecast	*Lophodermella arcuata* (Darker) Darker
White Pocket Rot	*Phellinus pini* (Thore:Fr.) A.Ames

RECENT PUBLICATIONS

2003

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